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AQA GCSE (9-1) PHYSICS 8463

SEPARATE SCIENCE / TRIPLE SCIENCE

EQUATIONS, METHODS & PRACTICAL-MATHS HANDBOOK

Current full equation-sheet regime | Foundation + Higher

Equation selection | units | rearrangement | worked independent examples | practical maths | checks

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Current equation-sheet regime

For 2027 the full Physics Equations Sheet is provided with both 8463 papers, unchanged from 2026. Ofqual has confirmed that equation sheets continue from 2028 for the lifetime of the current qualification. From 2028, standard-demand questions will not be set if they can be answered solely by transferring information from the sheet. Students therefore still need to select, rearrange, convert units, substitute and interpret correctly.

Sources: EQPOL; EQ

Equation selection routine

- 1. Write the target quantity and unit.
- 2. List the quantities given and convert them to a consistent SI system where needed.
- 3. Select an equation containing the target and known quantities.
- 4. Rearrange symbolically before substitution if required.
- 5. Substitute with units/significant figures.
- 6. Sense-check magnitude, sign and unit.

01. Kinetic energy

Relationship	**Ek = 1/2 m v^2**
Tier / scope	F/H
Symbols / units	Ek J; m kg; v m/s

Selection note: Square velocity; use for moving-object energy.

Worked example: A 1200 kg car moving at 15 m/s has Ek = 0.5 x 1200 x 15^2 = 135,000 J.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

02. Gravitational potential energy

Relationship	**Ep = m g h**
Tier / scope	F/H
Symbols / units	Ep J; m kg; g N/kg; h m

Selection note: Height must be vertical change in metres.

Worked example: A 2.0 kg object lifted 3.0 m with g=9.8 N/kg gains 58.8 J.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

03. Elastic potential energy

Relationship	**Ee = 1/2 k e^2**
Tier / scope	H emphasis
Symbols / units	Ee J; k N/m; e m

Selection note: Use in Hooke-law region unless question indicates otherwise.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

04. Power from energy

Relationship	**P = E / t**
Tier / scope	F/H
Symbols / units	P W; E J; t s

Selection note: Rate of energy transfer.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

05. Power from work

Relationship	**P = W / t**
Tier / scope	F/H
Symbols / units	P W; W J; t s

Selection note: Rate of doing work.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

06. Specific heat capacity

Relationship	**Delta E = m c Delta theta**
Tier / scope	F/H
Symbols / units	DeltaE J; m kg; c J/kg C; temperature C

Selection note: Temperature change, not final temperature.

Worked example: Heating 0.50 kg of material by 20 C with c=900 J/kg C requires 9000 J.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

07. Specific latent heat

Relationship	**E = m L**
Tier / scope	F/H
Symbols / units	E J; m kg; L J/kg

Selection note: State change at constant temperature idealisation.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

08. Efficiency (energy)

Relationship	**efficiency = useful energy output / total energy input**
Tier / scope	F/H
Symbols / units	dimensionless or %

Selection note: Multiply decimal by 100 for percentage.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

09. Efficiency (power)

Relationship	**efficiency = useful power output / total power input**
Tier / scope	F/H
Symbols / units	dimensionless or %

Selection note: Same time interval assumed.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

10. Charge flow

Relationship	**Q = I t**
Tier / scope	F/H
Symbols / units	Q C; I A; t s

Selection note: Charge = current x time.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

11. Potential difference / resistance

Relationship	**V = I R**
Tier / scope	F/H
Symbols / units	V V; I A; R ohm

Selection note: Ohmic relation at stated operating conditions.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

12. Electrical power

Relationship	**P = V I**
Tier / scope	F/H
Symbols / units	P W; V V; I A

Selection note: Useful for appliance/circuit power.

Worked example: At 12 V and 0.50 A, P = 6.0 W.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

13. Electrical power in resistor

Relationship	**P = I^2 R**
Tier / scope	F/H
Symbols / units	P W; I A; R ohm

Selection note: Square current.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

14. Electrical energy

Relationship	**E = P t**
Tier / scope	F/H
Symbols / units	E J; P W; t s

Selection note: Convert hours if using watts and joules.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

15. Energy transferred by charge

Relationship	**E = Q V**
Tier / scope	F/H
Symbols / units	E J; Q C; V V

Selection note: Energy per coulomb interpretation.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

16. Density

Relationship	**rho = m / V**
Tier / scope	F/H
Symbols / units	kg/m3 or g/cm3 consistently

Selection note: Keep unit system consistent.

Worked example: A 0.54 kg block occupying 2.0e-4 m3 has density 2700 kg/m3.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

17. Gas pressure-volume

Relationship	**p V = constant**
Tier / scope	HT
Symbols / units	p Pa; V m3 or consistent pair

Selection note: Fixed mass, constant temperature.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

18. Weight

Relationship	**W = m g**
Tier / scope	F/H
Symbols / units	W N; m kg; g N/kg

Selection note: Mass is kg; weight is force.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

19. Work done

Relationship	**W = F s**
Tier / scope	F/H
Symbols / units	W J; F N; s m

Selection note: Distance along line of action.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

20. Hooke law

Relationship	**F = k e**
Tier / scope	F/H
Symbols / units	F N; k N/m; e m

Selection note: Valid in proportional region.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

21. Moment

Relationship	**M = F d**
Tier / scope	F/H
Symbols / units	M Nm; F N; d m

Selection note: d is perpendicular distance to force line.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

22. Pressure

Relationship	**p = F / A**
Tier / scope	F/H
Symbols / units	p Pa; F N; A m2

Selection note: Force normal to surface.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

23. Liquid pressure

Relationship	**p = h rho g**
Tier / scope	HT
Symbols / units	p Pa; h m; rho kg/m3; g N/kg

Selection note: Gauge pressure due to liquid column.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

24. Uniform speed

Relationship	**s = v t**
Tier / scope	F/H
Symbols / units	s m; v m/s; t s

Selection note: Only directly for constant speed.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

25. Acceleration

Relationship	**a = Delta v / t**
Tier / scope	F/H
Symbols / units	a m/s2; v m/s; t s

Selection note: Velocity change can be signed.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

26. SUVAT relation

Relationship	**v^2 - u^2 = 2 a s**
Tier / scope	F/H
Symbols / units	m/s, m/s2, m

Selection note: Constant acceleration.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

27. Newton second law

Relationship	**F = m a**
Tier / scope	F/H
Symbols / units	F N; m kg; a m/s2

Selection note: F is resultant force.

Worked example: A 24 N resultant on 6.0 kg produces 4.0 m/s2 acceleration.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

28. Momentum

Relationship	**p = m v**
Tier / scope	HT
Symbols / units	kg m/s

Selection note: Vector direction/sign matters.

Worked example: A 0.20 kg ball at 15 m/s has momentum 3.0 kg m/s.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

29. Force from momentum change

Relationship	**F = Delta p / Delta t**
Tier / scope	HT
Symbols / units	F N; p kg m/s; t s

Selection note: Average force over interval.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

30. Period-frequency

Relationship	**T = 1 / f**
Tier / scope	F/H
Symbols / units	T s; f Hz

Selection note: Reciprocal relationship.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

31. Wave speed

Relationship	**v = f lambda**
Tier / scope	F/H
Symbols / units	v m/s; f Hz; lambda m

Selection note: Frequency set by source across boundary.

Worked example: A 50 Hz wave with wavelength 0.80 m travels at 40 m/s.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

32. Magnification

Relationship	**magnification = image height / object height**
Tier / scope	F/H
Symbols / units	same length units

Selection note: Dimensionless.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

33. Motor effect

Relationship	**F = B I l**
Tier / scope	HT
Symbols / units	F N; B T; I A; l m

Selection note: Conductor perpendicular to field.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

34. Transformer turns ratio

Relationship	**$V_p / V_s = n_p / n_s$**
Tier / scope	HT
Symbols / units	volts and turns

Selection note: Label primary/secondary before substituting.

Worked example: If np=600, ns=30 and Vp=230 V, Vs=11.5 V.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

35. Ideal transformer power

Relationship	**$V_p I_p = V_s I_s$**
Tier / scope	HT
Symbols / units	V, A

Selection note: Ideal / negligible losses assumption.

Check: Verify unit, order of magnitude and whether the physical conditions for the relationship are satisfied.

Specification/equation source: EQ; SPEC

Required-practical calculation toolkit

RP1: Specific heat capacity

Measure mass, temperature rise, current, potential difference and time. Electrical work can be estimated from E=VIt (or power x time); compare with DeltaE=mcDeltaT. Plotting temperature change against energy can support c determination.

Error/control focus: Major controls/errors: heat loss to surroundings, poor thermal contact, thermometer lag.

Source mapping: PRACT; RPG

RP2: Thermal insulation

Keep container geometry/starting temperature/volume controlled; compare temperature change over equal time.

Error/control focus: Major controls/errors: lid, surface area, thickness, drafts, probe position.

Source mapping: PRACT; RPG

RP3: Resistance of wire

Measure V and I for different wire lengths at controlled temperature; R=V/I.

Error/control focus: Major controls/errors: wire heating changes resistance; contact resistance; length measurement.

Source mapping: PRACT; RPG

RP4: I-V characteristics

Vary potential difference/current and plot I against V for resistor/lamp/diode.

Error/control focus: Major controls/errors: polarity for diode; heating of filament; scale choice.

Source mapping: PRACT; RPG

RP5: Density

Regular solid: geometry volume; irregular solid: displacement; liquid: mass difference / measured volume.

Error/control focus: Major controls/errors: meniscus, trapped air, balance zero, displaced-string volume.

Source mapping: PRACT; RPG

RP6: Force-extension

Extension = stretched length - original length; plot force-extension and identify proportional region.

Error/control focus: Major controls/errors: parallax, zero reading, oscillation, loading beyond elastic limit.

Source mapping: PRACT; RPG

RP7: Acceleration

Use motion sensor/light gates/timing to measure acceleration while varying force at constant mass and mass at constant force.

Error/control focus: Major controls/errors: friction, track tilt, mass definition, timing resolution.

Source mapping: PRACT; RPG

RP8: Waves

Measure wavelength over multiple wavelengths; frequency known/set; v=f lambda. For solid waves, use suitable timing/frequency arrangements.

Error/control focus: Major controls/errors: stationary pattern identification, ruler alignment, counting intervals.

Source mapping: PRACT; RPG

RP9: Reflection/refraction

Measure angles from the normal; repeat for materials/surfaces.

Error/control focus: Major controls/errors: thick pencil lines, ray alignment, measuring from surface instead of normal.

Source mapping: PRACT; RPG

RP10: Infrared surfaces

Compare emitted/absorbed IR for different surfaces with other variables controlled.

Error/control focus: Major controls/errors: distance/angle from detector, temperature equality, background radiation.

Source mapping: PRACT; RPG

Mathematical skills checklist

- Standard form and prefixes (milli, micro, kilo, mega).
- Ratios, percentages and proportionality.
- Rearranging multi-step equations.
- Gradients and areas of graphs.
- Mean and uncertainty estimates from repeated data.
- Significant figures and sensible rounding.
- Vector direction/sign for velocity, force and momentum.
- Unit conversion for area/volume (square/cube factors).

Source register

Source keys are used throughout the handbook so that curriculum, data and examiner-evidence statements can be audited. URLs are provided for verification; this publication paraphrases rather than reproduces protected assessment material.

Key	Source	URL
SPEC	AQA GCSE Physics 8463 specification (current web specification; first teaching 2016).	https://www.aqa.org.uk/subjects/physics/gcse/physics-8463/specification
GLANCE	AQA GCSE Physics 8463 specification at a glance: paper structure and topic split.	https://www.aqa.org.uk/subjects/physics/gcse/physics-8463/specification/specification-at-a-glance
PRACT	AQA GCSE Physics 8463 practical assessment: apparatus/techniques and 10 required practicals.	https://www.aqa.org.uk/subjects/physics/gcse/physics-8463/specification/practical-assessment
EQ	AQA GCSE Physics 8463 Appendix A: Physics equations.	https://www.aqa.org.uk/subjects/physics/gcse/physics-8463/specification/appendix-a-physics-equations
EQPOL	AQA, GCSE Maths and GCSE Sciences formulae and equation sheets for 2027 and 2028 onwards, published 1 Sep 2026.	https://www.aqa.org.uk/news/gcse-maths-sciences-formulae-equation-sheets-2027-28
GB	AQA grade-boundary publications, June 2022-2026.	https://www.aqa.org.uk/exams-administration/results-days/grade-boundaries
RS	AQA results-statistics publications, June 2022-2026.	https://www.aqa.org.uk/exams-administration/results-days/results-statistics
ER22	AQA GCSE Physics 8463 examiner reports, June 2022 (Paper 1 Higher and related reports).	https://filestore.aqa.org.uk/sample-papers-and-mark-schemes/2022/june/AQA-84631H-WRE-JUN22.PDF
ER23P1	AQA GCSE Physics 8463 examiner report, June 2023 Paper 1 Higher.	https://filestore.aqa.org.uk/sample-papers-and-mark-schemes/2023/june/AQA-84631H-WRE-JUN23.PDF
ER23P2	AQA GCSE Physics 8463 examiner report, June 2023 Paper 2 Higher.	https://filestore.aqa.org.uk/sample-papers-and-mark-schemes/2023/june/AQA-84632H-WRE-JUN23.PDF
RPG	AQA GCSE Physics required practical activities teacher/student practical resource.	https://filestore.aqa.org.uk/resources/physics/AQA-8463-PRACTICALS.PDF